We claim:

1. A semiconductor optical device comprising:

a transverse Bragg resonance waveguide comprised in turn of a waveguiding channel, and on at least two opposing sides of the channel two periodic index media; and

means for providing gain in the periodic index media.

2. The semiconductor optical device of claim 1 where the device is included within a laser.

3. The semiconductor optical device of claim 1 where the device is included within an amplifier.

4. The semiconductor optical device of claim 1 where the device is included within an oscillator.

5. The semiconductor optical device of claim 1 where the waveguiding channel is planar and is sandwiched on two opposing sides by the periodic index media.

6. The semiconductor optical device of claim 1 where the waveguiding channel is cylindrical and is surrounded by the periodic index media.

7. The semiconductor optical device of claim 1 where the means for providing gain in the periodic index media is electrical.

8. The semiconductor optical device of claim 1 where the means for providing gain in the periodic index media is optical.

9. The semiconductor optical device of claim 1 where the periodic index media comprises a periodic lattice of regions having an index of refraction distinct from the channel.

10. The semiconductor optical device of claim 9 where the periodic lattice comprises an array of transverse holes defined in a planar semiconductor substrate in which the channel is also defined.

11. The semiconductor optical device of claim 9 where the periodic lattice comprises an array of longitudinal holes defined in a cylindrical semiconductor fiber in which the channel is also longitudinally defined.

12. A method of operating a semiconductor optical device comprising:

propagating a light wave within a transverse Bragg resonance waveguide comprised of a waveguiding channel, and on at least two opposing sides of the channel two periodic index media; and

providing gain in the periodic index media while propagating the light wave.

13. The method of claim 12 where propagating a light wave is performed within a laser.

14. The method of claim 12 where propagating a light wave is performed within an amplifier.

15. The method of claim 12 where propagating a light wave is performed within an oscillator.

16. A method of providing an active transverse Bragg resonance waveguide comprising fabricating a planar waveguiding channel and sandwiching the planar waveguiding channel on two opposing sides by a periodic index media, and providing gain to the periodic index media.

17. A method of providing an active transverse Bragg resonance waveguide comprising fabricating a cylindrical waveguiding channel and surrounding the

cylindrical waveguiding channel by a periodic index media, and providing gain to the periodic index media.

18. The method of claim 12 where providing gain in the periodic index media comprises electrically pumping the periodic index media.

19. The method of claim 12 where providing gain in the periodic index media comprises optically pumping the periodic index media.

20. The method of claim 12 where propagating a light wave comprises propagating a light wave at a detuned frequency given by $k_0 = (1 + v)\,\pi/b$ where k_0 is the modal wave number of the propagated light, v is the frequency, and b is the transverse periodicity of the periodic index media.

21. The method of claim 12 where the semiconductor optical device is operated in a mode which has a gain enhancement, η, due to an increase of a gain constant, β_I, of the propagating wave over the gain constant of a bulk dielectric and a substantial electric field content outside the channel leading to a larger modal cross-sectional area, and higher output power.